

DRAFT

Water Management Strategy/ Integrated Storage Investigation Work Plan

Introduction

CALFED's Water Management Strategy (WMS) will evaluate and compare many tools and approaches for addressing the issue of water supply reliability in the Bay-Delta system. The Water Management Strategy has three broad purposes:

- Develop a menu of water management tools that can be used to attain CALFED's water supply reliability goals.
- Identify specific water management tools from this menu that will be implemented in Stage 1 of the CALFED Bay-Delta Program.
- Provide a long-term decision making framework for evaluating the success of implementation efforts and for selecting additional tools needed to achieve CALFED's objectives.

CALFED has initiated an Integrated Storage Investigation (ISI) to provide information to help determine the appropriate role of storage in its WMS. The ISI coordinates existing storage investigations being conducted by individual CALFED agencies, CALFED-initiated storage evaluations and broader water management strategies and analysis to provide a comprehensive assessment of alternative storage options and their utility to overall water management. Because of the need to consider the interrelationships between storage and other water management tools, there is considerable overlap in the scope of studies initiated under the ISI and general studies initiated under the broader WMS. Elements of all WMS and ISI tasks will provide information for two general purposes. The first of these purposes is to help finalize a WMS as a component of CALFED's programmatic plan by the conclusion of Phase II of the Program. An important aspect of this effort is to facilitate the development of an agreement among CALFED agencies on compliance with Section 404 of the Clean Water Act. A second, longer-term purpose of these tasks is to aid in development and implementation of specific water management tools over the duration of the CALFED Program (Phase III).

CALFED

Water Management Strategy

CALFED has identified three primary water supply reliability goals:

- Goal A: Increase the utility of available water supplies (making water suitable for more uses and reuses).
- Goal B: Improve access to existing or new water supplies, in an economically efficient manner, for environmental, urban and agricultural beneficial uses.
- Goal C: Improve flexibility of managing water supply and demand in order to reduce conflicts between beneficial uses, improve access to water supplies, and decrease system vulnerability.

The primary **tools** CALFED will use to achieve the goals and objectives of the Water Management Strategy include:

- Water Use Efficiency Program (agricultural, urban, and wetland water conservation and water recycling)
- Water Transfer Program
- Conveyance, including South Delta Improvements
- Storage
- Operational strategies

Approach to a CALFED Water Management Strategy

As demonstrated by the diversity of views in the ongoing debate regarding appropriate water management in California, CALFED's WMS might take many different forms. Because of the complexity of California water management issues, it is not possible to produce an optimal WMS without making numerous value judgements. For example, a WMS that emphasizes water use efficiency measures and excludes new storage might avoid some environmental impacts associated with new storage, but could result in an escalated price of water with significant economic and social impacts. Conversely, a WMS that emphasizes new storage and minimizes water use efficiency measures could provide economic benefits, yet lead to inappropriate use of water.

CALFED's approach to developing a WMS will include evaluating a number of possible water management scenarios that emphasize different types of water management tools. These water management scenarios will include assumptions regarding availability of facilities, operational goals, future demand for water, and costs of various water management actions. The outcome of this analysis will be a description of the expected economic, environmental, and social tradeoffs associated with these various water management scenarios. This information will be presented to CALFED policy makers to assist them in their efforts to balance these tradeoffs and craft a final WMS.

The foundation of this WMS analysis will be derived from many different areas of the CALFED Program. CALFED's Water Use Efficiency Program and Water Transfers Program have been under development throughout Phase II of the CALFED Program. Estimates of the availability and cost of water use efficiency and recycling measures as well as the potential for market-based transfers as components of CALFED's WMS will be based upon this work. Additionally, DWR and USBR have ongoing studies of surface and groundwater storage opportunities. While these studies are expected to continue for several years, preliminary information will be drawn from these efforts to help define the potential costs, benefits, and impacts of potential water storage projects.

In addition to these longer-term efforts, CALFED has implemented a number of new work tasks to assist in developing a WMS. Most of these tasks are intended to provide additional preliminary information to help refine possible facility configurations and operational parameters to be considered in alternative water management scenarios. CALFED, DWR, and USBR staff are leading these efforts, with guidance and participation from other CALFED agencies, consultants, stakeholder representatives, and independent experts. Tasks include completion of a reservoir screening report, economic evaluations of water management alternatives, hydroelectric facility re-operation studies, assessments of riverine processes, drinking water quality operation studies, and operational flexibility studies.

All of these efforts are intended to lead to a comprehensive analysis of the economic, environmental, and social tradeoffs associated with alternative water management scenarios. This comprehensive analysis will involve a number of steps. The first step, development of an analytical framework, will include development of a conceptual model to help illustrate the consequences of alternative water management scenarios. This step will also include formulating an appropriate set of alternative water management scenarios to reflect emphasis on

a variety of tools and consider uncertainty in future water demand and technological advancement, as well as developing an analytical procedure for evaluating the hydrologic and economic consequences of these scenarios. The second step of the comprehensive analysis will include conducting hydrologic and economic evaluations and assessing environmental and social impacts of the alternative water management scenarios. Summary results will be presented to CALFED policy makers. The final step of the comprehensive analysis will include documenting the study findings and finalizing the WMS.

This final WMS will include 1) an identification of specific water management tools that will be implemented in Stage 1 of the CALFED Bay-Delta Program and 2) a long-term decision making framework for evaluating the success of implementation efforts and for selecting additional tools needed to achieve CALFED's objectives. To assist in the first of these efforts, CALFED is establishing a Water Management Development Team. This team, consisting of CALFED agency and stakeholder representatives, will advise CALFED policy makers on the appropriate water management tools to be implemented during Stage 1 to meet the multiple needs of the Program. The Water Management Development Team will be advised of findings of the various WMS studies on an ongoing basis and provide guidance on study methodology.

This work plan has been formulated with the intention of providing initial information on the tradeoffs associated with alternative water management scenarios to policy makers in December 1999. Interim information made available from ongoing study efforts will be provided to the Water Management Development Team on an ongoing basis, leading to a initial proposal on Stage 1 water management tools also in December of 1999. The WMS will be finalized in spring 2000, including a long-term decision making framework for evaluating the success of implementation efforts and for selecting additional tools needed to achieve CALFED's objectives. A timeline for these efforts is displayed below as well as a more detailed description of the various tasks. Further refinement of this work plan will occur on an ongoing basis.

Task Description

As indicated above, a number of ongoing efforts will contribute towards development of CALFED's WMS. These efforts are described below under the categories of Associated Studies, WMS Preliminary Analysis, and WMS Comprehensive Analysis.

Associated Studies

Several associated studies will provide important information in developing CALFED's WMS. These efforts include CALFED's Water Transfers Program and Water Use Efficiency Program, studies of surface and groundwater storage opportunities underway by CALFED, DWR, and USBR, development of hydrologic and economic modeling tools, and a study of potential fish barrier removal opportunities initiated as a component of CALFED's ISI.

Water Transfer Program

Water transfers are an important part of water management in California and offer the potential to play an even more significant role in the future. Transfers can provide an effective means of moving water between users on a voluntary and compensated basis, as well as a means of

providing incentives for water users to implement management practices which will improve the effectiveness of local water management. The Water Transfer Program includes a strategic set of actions, policies and processes which will encourage the development of a market that facilitates water transfers and streamlines the approval process, while protecting water rights, environmental conditions and local economic interests.

Over the next few years, CALFED will work with state and federal agencies and stakeholders to develop and implement refinements and changes to current policies and processes. Collectively, these will improve the efficiency and effectiveness of moving water through a market based system. This work will be done through a coordinated group of DWR, USBR, and SWRCB staff working with CALFED staff and consultants. Water Transfer Program staff will assist in development of CALFED's WMS to ensure consistency between assumptions of the two efforts. FY 2000 funding for the Water Transfer Program is expected to be \$1.2 million.

The Water Transfer Program is described more completely in the *Water Transfer Program Plan* component of CALFED's Draft Programmatic EIS/EIR, June 1999.

Water Use Efficiency Program

The CALFED Water Use Efficiency Program is one of the cornerstones of CALFED's Water Management Strategy. CALFED's policy toward water use efficiency is a reflection of the State of California legal requirements for reasonable and beneficial use of water. Over the next several years, CALFED will work with stakeholders and CALFED agencies to 1) establish quantifiable objectives, 2) expand programs to provide planning, technical, and financial assistance, and 3) monitor progress towards objectives. If these objectives are not met, the program will be re-evaluated. CALFED agencies will also support institutional arrangements that give local water suppliers an opportunity to demonstrate that cost-effective efficiency measures are being implemented.

The Water Use Efficiency Program will be implemented by a coordinated group of CALFED agency staff working with CALFED staff and consultants on a variety of teams. The FY 2000 budget includes funds to support staff as well as grant and loan programs and additional studies that need to be completed (i.e., investigate how to create "appropriate measurement" for agriculture). About \$80 million of state and federal funding is expected to be available in FY 2000 for these types of activities. Most of this (about \$70 million) is allocated for water recycling grant and loan programs.

Regional estimates of the cost and availability of water use efficiency and water recycling measures to be considered in the WMS comprehensive analysis effort will be based upon work conducted in developing the Water Use Efficiency Program.

The Water Use Efficiency Program is described more completely in the *Water Use Efficiency Program Plan* component of CALFED's Draft Programmatic EIS/EIR, June 1999.

Surface Storage Investigations

North of Delta Offstream Storage Investigation. This DWR study was initially authorized under the Safe, Clean, Reliable Water Supply Act of 1996 and is continuing under augmented funding provided through the State budget process. Its scope was developed in coordination with the CALFED Bay-Delta Program, and includes four potential reservoir projects on the west side of the Sacramento Valley. The proposed projects would rely on a mix of local runoff and/or diversions from the Sacramento River to develop additional water supply reliability. This effort will provide site-specific biological, operational, and cost information that is essential to develop a realistic storage strategy. Information developed through this investigation will be used to refine evaluations conducted under the WMS comprehensive analysis. The FY 2000 funding for this investigation is \$4.2 million.

On-Stream Storage Enlargement Investigations. USBR has completed an initial assessment of potential Lake Shasta enlargement alternatives. Of several alternatives considered, raising the maximum storage elevation of the lake by about 6 feet through modification of Shasta Dam was selected for further study. This alternative would expand the capacity of Lake Shasta by about 290,000 acre-feet. Potential impacts of primary concern include additional inundation of streams entering the lake, loss of terrestrial habitat, and impacts on recreation facilities on the existing shoreline. USBR is also formulating a study of the enlargement of Millerton Reservoir by modifying Friant Dam for potential improvements in flood control, water supply reliability, and ecosystem restoration. Any available information developed through this investigation will be considered in CALFED's WMS comprehensive analysis. The FY 2000 budget includes about \$2 million for these on-stream storage enlargement investigations.

Groundwater Studies

Groundwater conjunctive use and banking offer great potential as tools for improving California water management. However, a variety of issues are currently impeding implementation of groundwater projects. While all potential projects face technical obstacles, these problems can usually be overcome through proper design and appropriate operational parameters. Addressing institutional concerns and crafting acceptable assurances that local rights will be protected are more difficult. For the past two years, CALFED has conducted outreach to local communities and agencies. Clearly, the general consensus of the water community and CALFED is that local control is the most important element of successful conjunctive use programs in California.

DWR, USBR, and CALFED are cooperatively developing a scope of work for addressing the issues impeding groundwater programs and moving towards implementation of safe, broadly supported projects. Under this effort, the conjunctive management of surface and groundwater resources will be considered on a regional, basin by basin approach. Local stakeholders would be invited to serve on advisory panels to actively participate in the planning process. A FY 2000 budget of \$2.2 million has been directed to DWR for initiating feasibility studies, designing groundwater models and groundwater monitoring programs, implementing pilot programs, and eventual implementation of projects. Additionally, CALFED is anticipating that federal funds on the order of \$2 million will be available in FY 2000 to provide grants or loans to local agencies interested in implementing feasibility studies or pilot programs for groundwater conjunctive use projects.

More immediately, CALFED is initiating a process to refine preliminary assumptions regarding potential groundwater conjunctive use and banking programs. In consultation with USBR, DWR, and stakeholder representatives, CALFED will develop several sets of estimates of parameters such as the extent of groundwater storage, recharge capacity, and extraction capacity available on a broad regional basis under various assumptions regarding constraints to implementation. This task will be conducted between July 1, 1999 and October 15, 1999 and provide input to the WMS comprehensive analysis.

In-Delta Storage Studies

In-Delta storage could provide significant operational flexibility to enhance water supply reliability, water quality, and ecosystem benefits. Water would be pumped from Delta channels when conditions allow, and pumped back into Delta channels in times when there is a demand for the water. An alternative explored by CALFED would connect in-Delta storage to the export facilities in the south Delta, thus eliminating a second screening cycle for export water supplies. In-Delta storage may have several unique operational attributes for water quality and real time system operation. However, several issues must be addressed before the implementability of in-Delta storage can be determined. One such issue is the potential degradation of drinking water quality through contact with peat soils of Delta islands. CALFED is facilitating the formulation of a joint DWR-USBR study of these issues.

More immediately, CALFED will initiate a process to define preliminary assumptions regarding potential in-Delta storage. In consultation with agency and stakeholder representatives, CALFED will develop several sets of estimates under various assumptions regarding constraints to implementation. This work, which will provide input to the WMS comprehensive analysis, will be completed by November 15, 1999. Available FY 2000 funding for in-Delta storage studies is about \$600,000.

Model Development

An obstacle to system-wide water management evaluations has historically been the lack of adequate analytical tools. An important aspect of the WMS is to improve these tools to aid in comprehensive evaluations. Significant improvements can be made in these models over the first year of the WMS; however, an investment in longer-term model development efforts is also appropriate.

Longer-Term Model Development. DWR is currently undertaking a coordinated effort with the USBR to develop a new system operations model, CALSIM. This model will provide a significant improvement over operation models currently used by both DWR and USBR. The primary advantage of the new model is a simplified programming language that will allow more flexible modifications for simulation of various facilities and operation conditions. With additional development, CALSIM will allow improved simulation of surface-groundwater interactions, evaluation of water quality effects, and shorter time steps for more realistic simulations. U.C. Davis is currently undertaking an effort to develop a new statewide model (CALVIN) that combines water management and economic performance. Additional refinement of urban and agricultural economic models, groundwater models, and Delta simulation models will also improve analytical capability. CALFED is providing \$430,000 for these longer-term model development efforts during FY 2000.

Integrated Hydrologic-Economic Model Development. With assistance from CALFED consultants and DWR staff, several analytical tools are being integrated to conduct a detailed evaluation of alternative water management scenarios. The analytical tools include a reservoir operation model, a groundwater flow model, an urban economics model, and an agricultural economics model. Integration of these tools provides necessary detailed information on groundwater impacts, Delta conveyance constraints, and regional economic impacts associated with alternative water management scenarios. This model development effort is proceeding with input from stakeholders and economists and will be conducted between July 1, 1999 and December 15, 1999. Products from this effort will be used to complete the WMS comprehensive analysis. Funding available for this task in FY 2000 is \$560,000.

Fish Barrier Removal Investigations

As part of CALFED's Ecosystem Restoration Program, modification or removal of some obstructions to fish passage (such as small dams) is being considered in order to restore anadromous fish access to critical spawning habitat. Funding provided through CALFED's ISI will allow a more systematic approach to identifying and prioritizing barriers for future action. DWR, in consultation with DFG and other CALFED agencies will prepare an initial assessment to identify and prioritize barriers for future action. This initial assessment may lead to additional refinement efforts at a later date. Funding will also be provided to the Upper Yuba River Study to initiate detailed study of alternatives to removing barriers to anadromous fish passage in that watershed. More immediately, an assessment of the potential effect of fish barrier removal efforts on CALFED's WMS will be completed by November 15, 1999. About \$1.3 million is expected to be available during FY 2000 for these efforts.

WMS Preliminary Analysis

CALFED has recently initiated a number of new work tasks to assist in developing a WMS. Most of these tasks are short-term in scope, and intended to provide additional preliminary information to help refine possible facility configurations and operational parameters to be considered in the WMS comprehensive analysis.

Reservoir Screening Report

A comprehensive inventory of potential surface storage facilities in the Central Valley was completed and summarized in a draft 1997 report. This inventory report briefly describes the primary characteristics and considerations of 52 alternative reservoir projects based upon previous investigations conducted by local, state, and federal agencies. CALFED has conducted analyses of these alternative reservoir projects related to conflicts with CALFED solution principles, engineering constraints, yield evaluations, cost analyses, and economic evaluations, resulting in a list of 12 alternative reservoir projects to be subjected to further evaluation. CALFED will prepare a report to document these analyses. This task will be conducted between July 1, 1999 and October 15, 1999 with a FY 2000 budget of \$50,000.

Economic Evaluations

The purpose of CALFED's Economic Evaluation of Water Management Alternatives (EEWMA) is to provide an initial screening, based on cost-effectiveness, of different combinations of water management options to meet California's anticipated 2020 water demand. The EEWMA provides information on the likely magnitude of demands, how demands are affected by the future price of water, the supplies available to meet those demands, and the most cost-effective combination of those supplies. A screening-level analysis approach was developed, with input from stakeholders and economists, to analyze supply and demand using available information and accounting for uncertainty. The screening analysis is developing information (e.g. supply data and demand functions) that will be used to help define alternative water management scenarios for the WMS comprehensive evaluation.

A CALFED consultant is refining input information on costs and availability of water supply and demand reduction options based on input from CALFED staff, regional experts, and stakeholders. The analytical approach is being expanded from a dry year only evaluation to consider multiple year types to help define comprehensive water management strategies. Additional scenarios will be formulated and evaluated to help assess the water management implications of various storage configurations and operational rules. Additional sensitivity analyses may be performed to test various assumptions. This task will be conducted between July 1, 1999 and December 15, 1999 with a FY 2000 budget of \$680,000.

Hydroelectric Facilities Re-operation

The Bay-Delta system includes storage capacity dedicated to the generation of hydroelectric power. AB 1890 (Chapter 854, Statutes of 1996, Public Utilities: electrical restructuring) has triggered an evaluation and potential divestiture of some or all of these facilities. The potential exists to re-operate some of these hydroelectric facilities to produce water supply or ecosystem benefits.

A CALFED study is being conducted to evaluate the potential for re-operation of existing hydropower facilities to contribute to the Program's water management objectives. The study focuses on the potential for re-operation of hydropower facilities in the Sacramento River Basin for the purposes of improving water supply reliability for local, instream, and export needs. Potential impacts on fish and wildlife, recreation, and power production are being assessed. A report on potential benefits and impacts will be prepared by a CALFED consultant, including documentation and assumptions from technical studies completed. This task will be conducted between July 1, 1999 and October 1, 1999 with a FY 2000 budget of \$100,000.

Riverine Processes

A key question in the assessment of the role of storage in CALFED's water management strategy is the effect of storage operations on riverine processes. Changes in flow patterns due to storage operations and diversions for out of stream use can affect geomorphological and biological processes within riverine environments. The cumulative effect of existing storage operations and diversions together with potential re-operation of existing storage facilities, operation of new storage facilities, and changes in diversion patterns will be evaluated. Constraints to new storage

operations to protect riverine processes, consistent with the objectives of CALFED's Ecosystem Restoration Program, will be formulated and proposed.

A panel of experts in the field of geomorphology has been assembled to draft a white paper to answer specific questions regarding the effects of storage operations on riverine processes. A group of agency fisheries experts has also been organized to develop guidance on minimizing diversion effects on fisheries. The group's input will be incorporated into the white paper. A scientific review panel will also be assembled to provide peer review on this paper. A facilitated public workshop will be held to solicit public input and to present the paper and the scientific review panel's findings. This task will be conducted between July 1, 1999 and October 15, 1999 with a FY 2000 budget of \$200,000.

Drinking Water Quality Operation Rules

Prior to release of the draft PEIS/EIR and the revised Phase II report, a cooperative study led by CALFED and several urban stakeholders was initiated to explore the potential for water quality improvements through management of water project operations. A similar workgroup was assembled to further refine and analyze operational concepts for water quality improvement. A matrix of study scenarios is being developed to explore this objective considering a variety of possible storage facilities and operational arrangements. The workgroup is placing a special emphasis on rules related to new storage facility operations. Representatives from EPA, DWR, CCWD, MWDSC, SCVWD, EBMUD, CUWA, State Water Contractors, SLDMWA, and U.C. Davis were invited to participate. CALFED consultants are developing analytical tools and conducting model simulations to assist the workgroup in evaluating potential operating rules. A set of drinking water quality operating rules will be developed by October 15, 1999 for use in the WMS comprehensive analysis. The FY 2000 funding for this task is \$150,000.

System Flexibility Operation Rules

If new system storage were constructed under the CALFED Program, one objective would be to enhance operational flexibility in meeting environmental water requirements. Similarly, existing storage could be re-operated to improve system flexibility. A set of rules that promote system operational flexibility will be developed by mid-October 1999 for use in the ISI comprehensive analysis. These rules will be developed through evaluation of CALFED's Environmental Water Account "gaming" results and simulation of possible project outage scenarios. The FY 2000 funding for this task is \$30,000.

WMS Comprehensive Analysis

All of the efforts described above will contribute information towards a comprehensive analysis of the economic, environmental, and social tradeoffs associated with alternative water management scenarios. This process will include the steps of developing an analytical framework, conducting an analysis to illustrate tradeoffs, and finally, documenting findings and completing a final WMS. CALFED staff will lead the WMS comprehensive analysis, with guidance and assistance from CALFED agencies, consultants, and stakeholders. Budgets for these activities will be determined after additional scoping; however, about \$500,000 is available for this effort in FY 2000.

Analytical Framework Development

The first step in conducting a comprehensive analysis is to develop an analytical framework. This effort includes developing a conceptual model, formulation of scenarios, and development of analytical procedures.

Conceptual Model Development. The implications of alternative water management scenarios are difficult to predict and describe due to the complexities of California's water management system. A conceptual model of this system may help illustrate the consequences of alternative water management actions and allow testing of alternative hypotheses. This effort should be completed by November 15 1999.

Formulation of Alternative Water Management Scenarios. A number of water management scenarios will be formulated to illustrate the economic, environmental, and social tradeoffs associated with strategies that emphasize different water management tools. These scenarios must also consider a range of uncertainty in future demand for water due to variability in population growth projections and in the cost-effectiveness of alternative water management measures due to future technological advancements. At the same time, the number of scenarios must be limited to allow completion of the analytical process within the limited time available. This effort should be completed by November 1 1999.

Development of Analytical Procedures. An analytical process must be developed for evaluating the economic, environmental, and social tradeoffs of alternative water management scenarios. This process will draw upon work conducted in the model development and economic evaluation work efforts described above. The steps envisioned in this process include: 1) conducting system hydrologic analyses of a given water management scenario, making assumptions regarding available facilities, operational goals and constraints, and demand for water supplies, 2) conducting urban and agricultural economic evaluations to determine regional responses to the availability of Delta water supplies, 3) summarizing final water supply reliability and economic consequences on a regional basis, and 4) completing a qualitative evaluation of the environmental and social consequences associated with the given water management scenario. This effort should be completed by November 1 1999.

Analysis of Tradeoffs

The selected water management scenarios will be evaluated using the analytical procedures formulated through the process described above. A summary of the economic, environmental, and social tradeoffs of these alternative water management scenarios will be presented to CALFED policy makers in December 1999. The assessment process will be conducted with involvement of CALFED agencies and independent review of technical work.

Documentation

The results of the WMS comprehensive analysis, along with a description of assumptions and recommendations for future study, will be documented. A final WMS will be developed based upon guidance from CALFED policy makers. This final WMS will include 1) an identification

of specific water management tools that will be implemented in Stage 1 of the CALFED Bay-Delta Program and 2) provide a long-term decision making framework for evaluating the success of implementation efforts and for selecting additional tools needed to achieve CALFED's objectives. CALFED's Water Management Development Team will assist in the first of these efforts, by considering information developed through WMS studies and recommending specific water management tools for Stage 1 implementation.